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ABSTRACT

This dissertation abstract summarizes a research study which investigated the hypothesis that bilingualism in children would result in: (1) increased ability to analyze syntax; (2) acceleration in the time of arrival of the stage of concrete operational thinking; and (3) an increase in cognitive flexibility or ability to mentally shuffle material. Subjects were two groups of Hebrew-English speaking bilingual children; one group was tested in the United States and the other group was tested in Israel. Corresponding monolingual groups were also employed as controls. The mean age of the subjects was just under seven years. All subjects were given tests to measure vocabulary, intelligence, verbal transformation ability, paradigmatic association ability, knowledge of grammatical categories in the native language, symbol substitution ability, and transposition. It was concluded that only the third hypothesis was clearly supported and that the other two hypotheses required restatement since results indicated the situation was more complex than originally conceived. Two characteristics of the thinking of the bilingual child which were found in the research are also discussed. (SDH)

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The Problem and its Background.

This thesis was concerned with the problem of language learning in childhood. The focus was on how the experiences and efforts involved in such learning may affect general cognitive development and cognitive strategies. "Language" was taken to mean language as heard and spoken, but with particular reference to its structural aspect.

It is not easy to isolate language development from thought development in order to determine their relationship. In order to demonstrate the direction of influence it is necessary to demonstrate causality. This can be done by focusing on some unusual language learning situation and then testing to see if there is some change in conceptual organization as a result. Furth (1970) has attempted this by focusing upon the deaf, who are language-deprived individuals. Furth's conclusion from his own research and his review of the literature was that language has no direct effect upon conceptual development. Actually, however, the studies from which he drew his conclusions are highly conflicting in their results, with the weight of the evidence leaning towards the opposite conclusion, namely that deafness causes a definite retardation in intellectual performance.

In contrast to Furth's position, the present paper attempted to demonstrate, both theoretically and experimentally, that language has a direct, positive influence upon cognition. The first portion of the paper discussed language learning in general, and its effect on cognition, as well as the particular situation of bilingual language learning. The latter portion of the paper presented the results of an experiment which examined the cognitive development of bilingual children. Bilingualism, like deafness, is an unusual language learning situation. Whereas deafness is a situation of language deprivation, bilingualism is a situation of language enrichment (or satiation, depending on the point of view). Any differences in cognition which are found to result from the bilingual learning situation are informative concerning the process of language learning in general and its effects on thinking.

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Bilingual Language Learning and Monolingual Language Learning.

The position taken in the present study was that bilingual language learning is different in degree, but not in kind, from ordinary monolingual language learning. It was also maintained that for children during the pre-adolescent years it does not require unusual intelligence to become bilingual. Neurological evidence supports the idea that there is a critical period for language development which is between cerebral immaturity during infancy, on the one end, and termination of a state of organizational plasticity on the other. This is linked with lateralization of function and loss of ability to recover from trauma to the language-related areas of the brain (Penfield, 1959; Lenneberg, 1967). During this period it does not require high intelligence to learn a single language, nor should it require unusual intelligence to learn a second language.

This is not to maintain that language learning is a simple, automatic process, or that it is anything like imprinting. On the contrary, language should be regarded as an autogenic process. It is maintained that language learning involves intensive effort on the part of the child to absorb, and in a sense to create for himself, through the generation of hypotheses, the structure of his language. This is to maintain, following Cassirer (1953) that:

> "...the emergent genetic function that determines and gives significance to human development is the intention to know. This intentionality is reflected by the child's progressive tendency to construct knowledge, rather than to mirror or react to a preformed reality, as he develops. The emergent activity subserving this end is representation, or symbolic operations."

Once past the sensori-motor stage the efforts of the child to structure his world take many directions, but perhaps the main focus during the earlier part of the critical period for language learning is upon the development of language structure. The aspect of language which is most likely to be innate is neither the substantive nor the formal aspects of its organization but rather the directionality of the child's effort and the persistence with which he tries to create its structure for himself.

In the situation of childhood bilingualism the child is faced with an environment which places an external demand upon him to become bilingual at a time when his brain language centers are most plastic and thus most receptive to his efforts at mastering the linguistic structures. The learning processes for him are the same as for the monolingual learner except that in his case they are more intensive and require more mental activity. The bilingual must engage in more activity in order to master syntactic structure. Because he must keep his languages from mutual interference, he must come to understand his languages as differentiated and internally integrated systems.

Structural Conflict in Bilingual and Monolingual Language Learning.

The main factor which is expected to enhance the bilingual's mental development and to determine the direction of that development is not that the bilingual has two different syntactic structures to learn, although the latter is important. The main factor is that the bilingual experiences conflict between the two language structures, and must act to resolve the conflict.

Case studies of bilingual individuals indicate that these individuals experience problems resulting from internal interference between their two languages (Weinreich, 1953; Ronjat, 1913; Leopold, 1949; Burling, 1959). Various possible sources of such conflicts are outlined, on the phonemic, syntactic, and semantic levels. Grammatical errors made by a child in the process of becoming bilingual (reported by Raven, 1968) are analyzed to demonstrate that in the process of learning the second language the child engages in comparison of the abstract systemic features of both languages.

Evidence from varied sources,--etymology, acoustic research, social psychology, and the Chomskian school in linguistics--was examined to support the interpretation that ordinary language learning is saturated with structural conflict and the need for development of devices which allow conflict resolution. Concerning bilingualism, various factors which can influence the degree of bilingual conflict were discussed. The theory that there are two distinct types of bilingualism, "coordinate" and "compound" was critically evaluated in the light of the need for conflict resolution. Several mechanisms for linguistic conflict resolution were proposed and evidence was presented for each one.

The language conflict theory was compared to other theories of cognitive and linguistic development. The language conflict theory is completely consonant with Piaget's action theory of development, and in fact is derived from the latter theory, particularly its central concept, equilibration. However, Piaget himself does not conceive of language as being learned by means of more general action systems, and thus his interpretation differs from the present theory. The language conflict theory is also contrasted with nativistic theories of language acquisition, namely those of Lenneberg (1967) and McNeill (1966).

Language as an Action System.

Language is viewed as an action system with emphasis on both "action" and "system". It is maintained that language develops according to the same processes proposed by organismic theories for general development (Werner and Kaplan, 1963; Piaget, 1966; Inhelder and Piaget, 1964). The activity involved in language learning becomes apparent in studies of early grammar development, in which there is evidence that grammar is self-generated (Bloom, 1970). Examination of the stages by which particular grammatical constructions develop indicates that these stages involve transition from relatively global juxtaposition of semantic concepts to a

systemic structure with a definite integral pattern (Klima and Bellugi, 1966; Sapir, 1949).

It is hypothesized that the potential structure of language is not always in active operational focus in the mind of the individual. Three special situations are discussed which are likely to influence the activation level of language. These are: the period of initial language learning, when the semantic implications of grammatical structure are most likely to be in focus; environments such as school, in which there is interchange on matters which are not exclusively concrete; bilingualism, because bilingualism involves more intensive experience in linguistic structuring and because of the more intensive conflict involved.

An Experiment Relating Bilingualism to Certain Cognitive Tasks.

The original hypotheses which guided the selection of experimental tests were as follows. Bilingualism was expected to result in: (1) Increased ability to analyze syntax; (2) Acceleration in the time of arrival of the stage of concrete operational thinking; (3) Increase in cognitive flexibility or ability to mentally shuffle material.

No evidence was found in the literature related to the general theory that bilingualism influences cognitive development. However, there is some evidence which supports the general positive influence of cognitive conflict on cognitive development (Smedslund, 1961a, 1961b; Inhelder and Sinclair, 1967). Other evidence concerning the relationship of bilingualism to intelligence was critically analyzed (Arsenian, 1932; Darcy, 1953; Peal and Lambert, 1962).

The Sample.

The main sample consisted of two groups of Hebrew-English speaking bilingual children, one group tested in the United States and the other group tested in Israel. Corresponding to these groups were monolingual control groups, with those tested in the United States speaking only English and those tested in Israel speaking only Hebrew.

Ss were distributed by age and sex. The age range of the Ss was 5:4 to 8:6, with the mean just under seven years of age. Approximately one-half of the subjects in each group were male and the other half female.

All subjects were of Jewish parentage and from middle-class homes. In all groups the average father was college-educated. The four sample groups are fairly well balanced in terms of parental occupation. The United States bilingual sample parents have slightly more academicians among them as compared to the United States monolingual sample parents, among whom are more professionals. The Israeli parents are comparable to the American in occupations, although the Israeli parents of monolinguals tended slightly more towards graduate engineering and high-level creative arts. In addition to occupation, information was gathered from other sources concerning the "verbal"

level of the family. For those children who were tested in their homes, both in the United States and in Israel, an impression could be received by the tester directly. For those tested in school in Israel, information was received from the school nurse, who functions more or less as a psychologist, and who knows most of the parents. In the United States the parents of those children who were tested in school were telephoned and asked questions about the family's reading habits, etc. Considering this in total, the four groups did seem to be at comparable intellectual levels. There were a total of ninety-six Subjects.

The majority of the United States bilingual Subjects attended Hebrew Day School are were tested in their schools. Testing was done at three such day schools in the Chicago area and one in Brooklyn, New York. One subject was tested in Madison, Wisconsin. It was found that attendance at Hebrew day school in itself is insufficient to produce the level of bilingualism desired for this experiment at the age levels required. Therefore, in the case of all of the subjects selected, school language training was in fact supplemented by long-range outside experience with the Hebrew language. Most of these Subjects are Israelis who are living in the United States temporarily; other Subjects in the group have made extensive visits to Israel; one Subject has never been to Israel but has a parent who speaks to her exclusively in Hebrew.

The United States monolinguals were tested either in a public school in Skokie, Illinois, or in their homes in nearby suburban areas.

The Israeli bilinguals were tested in their homes in Jerusalem and suburbs of Tel Aviv. The monolinguals in Israel were tested in a school in Tel Aviv which was selected after consultation with the Israeli Ministry of Education because it is in a neighborhood of educated parents with responsible occupational positions.

The monolingual Subjects are completely monolingual in that they cannot understand simple conversation in any other language. In Israel, for example, if a child understood any English spoken to him he was eliminated from the sample. It was also ascertained by questioning whether the child spoke any other foreign language, and if so, he was eliminated.

Controls for Intelligence.

The intelligence score used for this study was based on an estimate from the Wechsler Intelligence Scale for Children. The full score was pro-rated from the following four WISC subtests: Similarities, Digit Span, Picture Completion, and Picture Arrangement. The choice of the WISC test, as well as the selection of the particular subtests of it which were used, was the result of a compromise between two conflicting criteria: (1)The study should use well-standardized measures of what is traditionally meant by "intelligence"; (2) The tests used should not be affected by the bilingualism factor itself. Thus, for example, the Vocabulary subtest could not be used as a measure of intelligence in this case, in spite of its high correlation with full-scale WISC

score, because bilinguals are likely to be disadvantaged on this test in a way which is irrelevant to intelligence. Bilinguals must divide their experience between two cultures and two languages, and they therefore have less opportunity to absorb the vocabulary of either of their languages. In fact, a vocabulary test was indeed used in this study, namely the Peabody Picture Vocabulary Test. However, this test was included not as an intelligence measure but as a dependent variable. The test was administered only to the two United States sample groups because of practical difficulties in finding a Hebrew vocabulary test as a substitute.

The Wechsler Intelligence Test was administered in Hebrew to the Hebrew-speaking monolinguals and to approximately one-half of the bilinguals in Israel. For the bilinguals the assignment of the Hebrew or the English form was made according to the tester's judgement of which language was spoken better by the child, as determined by an impression of his performance on a translation test given before the test battery proper. When no language bias could be determined for a member of the Israel bilingual group, the Hebrew and English forms were assigned in such a way that one-half of the group would receive one form and one-half the other form. The bilinguals in the United States were administered the English form only, because at that time the Hebrew form had not as yet been prepared.

By means of analysis of variance it was found that the difference in intelligence scores between the United States Ss and the Israel Ss was significant ($p < .05$, $F = 7.15$, $df = 1,92$). The most important finding for present purposes was that the difference between the bilinguals and the monolinguals was not significant, nor were the interaction factors. The means for these two groups, when averaged over nationality, were almost identical, as can be seen from the table below:

TABLE I

	Israel	United States	Combined
Bilinguals	108.45	118.45	113.45
Monolinguals	110.86	115.50	113.18
Combined	109.65	116.97	

The national differences were probably the result of unequal test experience. All the United States Subjects had previous experience in taking intelligence tests, whereas intelligence testing is not customary in Israel at this age level. The difference was not the result of any particular subtest, since for all subtests the United States means were higher, and to about an equal extent. The only verbal subtest, Similarities, did not show a different pattern from the nonverbal subtests.

All potential bilingual Subjects were first administered a fifteen-item translation test, in which the language of the items alternated regularly from Hebrew to English. The content of the items was simple, and was selected to cover a range of situations which might be encountered at home, in school, and with peers. In the case of every item a high score required much more than word-for-word translation; it required changing the order of parts of speech, as well as radically different types of construction, and in some cases idiomatic adaptations. The

following are examples, with attempts to render the Hebrew idiom:

English: Are you warm?
Hebrew: Is it hot to you?

Hebrew: Work (+feminine particle) hard.
English: Her work is hard.

If a child seemed to understand the sentences but could not translate them, or if he translated all items in a forced and literal manner, as in the Hebrew items literalized in the examples above, he was eliminated from the study.

There were two kinds of scores:

(1) Correctness of translation. This went from 0, perfect translation, to 4, inability to understand or to translate the sentence. A score of 2 indicated that the content of the translation was correct but the grammatical form was influenced by the other language.

(2) Translation balance. Translation errors could be biased towards the form of either language. A high bias score indicated that there was bias in the direction of one language, while a low bias score indicated good bilingual balance. Determination of scores by the rater required good knowledge of Hebrew structure and well-defined criteria for judgement. Because of the complexity, it was felt that a reliability check was required. Inter-rater agreement between this experiment and independent rating by an Israeli psychologist was high (r=.96).

If the bilingual performed satisfactorily on this test he was administered the same battery of tests given all bilingual and monolingual Subjects in the same order. Following the test battery the bilinguals were administered a special word association test which served as an additional measure of degree of bilingual balance. The Bilingual Word Association Test was in two parts. Both parts consisted of eighteen words, half of them in Hebrew and half in English, in random order. For the first list presented the Subject was instructed to respond to the stimulus words in whichever language seemed easiest to him. This was called the "Spontaneous" condition. For the second list presented the Subject was instructed to respond in the language of the stimulus word. Different lists were rotated among the different instructional conditions. Scores were as follows:

(1) Number of language switches, Spontaneous condition. This corresponds to the total number of responses which were of a different language from their stimulus. Exact translations were not permitted, to prevent a rigid response set.

(2) Balance of language switching, Spontaneous condition. A low score indicated that switches are not biased in the direction of one language or the other.

(3) Balance of response latency, Same-language condition. Low score means that the latency for responding to a Hebrew stimulus with a Hebrew response is not essentially different from the latency for responding to an English stimulus with an English response.

It is evident that these scores are concerned with establishing bilingual balance, as well as interlingual accessibility.

Statistical Procedures.

The program used was Multivariance--Univariate and Multivariate Analysis of Variance and Covariance: A Fortran IV Program, Version 4. In the first run there were four factors in the design, with two levels for each factor, as follows:

Age
Level 1: 5:4-6:11
Level 2: 7:0-8:6

Sex
Level 1: Male
Level 2: Female

Language Status
Level 1: Bilingual
Level 2: Monolingual

Location
Level 1: Israel
Level 2: United States

Wechsler intelligence test scores were treated as covariates. The four subtests as well as the total Wechsler scores were added separately. The program included a step-wise regression, so that the contribution of each of the five intelligence variables to the dependent variables could be analyzed separately. There were 24 dependent variables.

A second computer run consisting of the United States sample alone (56 Ss) was necessary, because the Peabody Vocabulary Test was administered only to this part of the sample. Independent variables were the Peabody total score, Wechsler estimated total score, and the Language Status factor. On this run the Ravens Matrices was treated as covariate, since on the previous run it did not show significant differences for the major variables. On this run the dependent variables were reduced to 12, and consisted of those which were most differentiating according to previous results.

The third run consisted of intercorrelations among several different measures of bilingual ability as well as other related variables. In the fourth run the attempt was to test whether the degree of bilingualism is related to the dependent variable measures. The independent variables for this were as follows:

Age
Age of Onset of Bilingualism
Level 1: 0-4:0
Level 2: 4:1-8:6
Translation Balance Score
Language Switching Balance Score

In the final run several different dependent variable tests were examined in greater detail. The Morphological Generalization Test and the Symbol Substitution Test were item-analyzed. (These tests as well as others are described below). The Word Association Test was recoded by a different coding system. Some additional measures besides total score were added for the Ravens Matrices Test. In this analysis also, Language of Testing was included as

an independent variable, to determine whether the Hebrew and English forms of the various tests differed significantly. This run involved the whole sample of 90 subjects.

Results.

All differences noted below were statistically significant, unless otherwise noted.

Vocabulary.

-----Bilinguals performed more poorly than monolinguals on the Peabody Vocabulary Test.

Intelligence.

-----On the WISC scores there were no differences between monolingual and bilingual Ss.

Verbal Transformations Test. (VT's).

In this test a verbal stimulus is repeated continually by means of a tape loop, and S must report what he hears. Warren and Warren (1966) found that when Ss listen to a clearly pronounced verbal stimulus presented in this way they report frequent changes in what the voice appears to say.

-----Bilinguals heard a higher total number of forms.
-----Bilinguals heard a higher number of different forms.
-----Bilinguals heard more forms in the first thirty seconds.
-----Bilinguals reported the first change to occur earlier.
-----There were no differences between groups in the number of meaningful forms.

It was concluded from these results that bilinguals have higher skill at auditory reorganization, which involves the willingness to abandon a non-adaptive perceptual hypothesis.

Paradigmatic Associations Test.

In this test S is required to give a one-word response to a stimulus word. Responses were classified as Paradigmatic, Syntagmatic, or Other. Paradigmatic responses are words of the same form class as the stimulus word, which typically occupy the same position in an utterance. Syntagmatic responses are words which might occupy a position in a sentence which is contiguous to that of the stimulus word. A Syntagmatic response could be the result of association based on simple contiguity or sequential probability, whereas a Paradigmatic response could not be based on simple contiguity, and necessarily involves cognizance of the underlying structure of the sentence, at least to the extent that the concept of grammatical form-class has been abstracted.

The stimulus list consisted of eighteen common words. The Hebrew list was a translation of the English list, except in cases where the translation word would be a homonym or would be otherwise ambiguous. All parts of speech were represented, with emphasis on verbs and adjectives because they do not predispose associations towards either Paradigmatic or Syntagmatic responses, as do other form classes (Deese, 1965).

-----Bilinguals have more responses in the Other category. It appears that their low vocabulary level causes bilinguals to experience associational difficulties.
-----There were no differences between groups in the number of Paradigmatic responses, though the means were higher for the bilinguals. Although this finding is negative, it is still suggestive of increased abstracting ability for grammatical material on the part of the bilingual. Ervin (1961) considers experience with particular words in different contexts as the mechanism which enables the kind of abstraction involved in Paradigmatic associations. If this were the only factor involved, then bilinguals could be expected to have fewer Paradigmatic responses, because they have less experience with particular words than do monolinguals. That bilinguals do not have a lower number of Paradigmatic responses may indicate that their experience with verbal conflict on a structural level sensitizes them to verbal categorization. Thus experience with verbal structural interference can be viewed as an alternate pathway towards understanding of verbal structure,--alternate to the pathway of generalization from particular semantic experience.
-----The tendency for bilinguals to respond in the Other category is especially marked at younger ages. This is indicated by the fact that an interaction factor between Bilingualism and Age almost reaches significance level. This may mean that the looser associative processes are delayed in bilinguals as they concentrate at younger age levels on the relationship between a word and its referent. This is at the expense of integrating the semantic content of the word into the more general field of semantic connotations.
-----Concerning the number of Paradigmatic associations, there is an interaction between Age and Recency of Bilingualism. Bilinguals who are young (5:4-6:11) and who have also become bilingual only recently have a high number of Paradigmatic associations. Bilinguals who are older (7:0-8:6) and who have become bilingual only recently have a very low number of Paradigmatic associations. This could mean that at younger ages recent bilingualism accelerates the verbal classificatory tendency, the need to structure. At older ages the sudden need to cope with bilingualism seems to inhibit structuration.
-----The Paradigmatic Association Test is very highly related to the country in which the test is given and to the language in which it is given. More Paradigmatic associates are given in the United States. The English language form of the test produces more Paradigmatic associates than the Hebrew form. This finding may have been the result of experimental conditions, but nevertheless it should serve as a caution in generalizing results for word association tests cross-culturally.

Morphological Generalization Test.

The Morphological Generalization Test is a test of the Subject's knowledge of the grammatical categories of his language. The test requires him to generalize syntactic coding rules by supplying appropriate morphemic additions to a nonsense word which has been inserted into a sentence framework which clearly requires some inflectional addition or change in the nonsense word. The format is taken from Berko (1958), although the present test includes a higher ability range than does Berko's test and it covers a greater

variety of syntactic forms, in accordance with the higher age range of the present sample.

As in the Berko study, while each sentence is read to the child he views a card on which a cartoon illustration depicts the nonsense word referent and the situation described by the sentence.

There is a Hebrew form and an English form of this test. The monolinguals were administered the appropriate language form. For each bilingual a judgement was made, on the basis of his performance in the initial translation test, concerning which language is most comfortable for him, and he was then administered the test in that language. For both language forms of the test the nonsense words are composed of phonemes which could occur in either language.

The paradigms included were: plural, past tense, comparative, superlative, passive, change of an adjective into an abstract noun, and change of an adjective into an adverb.

-----There were no differences in scores between bilinguals and monolinguals on this test. This tends to indicate that bilingualism does not have an effect on the learning of grammatical inflection.

Symbol Substitution Test.

This is a test of ability to use words as desemanticized units which are substitutable for one another within a general code system. This means that the word is no longer limited to its learned reference function within the conventional system of denotation. All of the test questions require the child to substitute one meaningful word for another within a given sentence frame. The earlier items test the involvement of the child in word magic because they require substitutions of meaning between words which represent concrete objects. The later items involve more complex grammatical substitutions, such as the ability to interchange parts of speech. Success on these items requires deliberate violation of the usual semantic selectional restrictions within the sentence. The child must resist the influence of the sentence frame on the form of the item, as well as the pressure exerted by the substituted item on the sentence which surrounds it.

Of the various tests used in this experiment which required translation into Hebrew, this test presented the most delicate translation problem. In several items some of the principle content words had to be changed in order that the Hebrew-speaking Subjects could be presented with the same set of underlying relationships and conflicts in the substitution tasks as their English-speaking counterparts. The problems of translation were analyzed with the help of an Israeli psychologist. Consideration was given to connotations, grammar, and to the appropriateness of the item for the age level and for the vernacular of the Hebrew-speaking children.

-----The bilinguals were definitely superior on this test (mean score, bilinguals=12.21; mean score, monolinguals=9.09; MS= 203.25; $p < .01$). This result indicates a high level of syntactic mastery on the part of the bilingual. Though bilinguals do not have a higher level of performance on a more conventional test of grammar, as indicated above, the ability they show on the present test to substitute minor parts of speech for major ones indicates that they are capable of a more flexible manipulation of the linguistic code in practice.

One can characterize word interpretation in terms of three stages. In the first stage the word tends to be used idiosyncratically, while at the same time its relationship to its external referent is felt to be immanent and absolute. This is the stage of word magic. In the second stage the word is used less idiosyncratically and becomes more specific in function, while its relationship to its sentence context becomes clearer. This is the stage of conventional word meaning. At a still higher stage the word is understood as an arbitrary unit of a larger symbolic coding system. Bilingualism appears to aid in advancement towards this third stage. For bilinguals the word is clearly an arbitrary unit, and is not limited to its learned referent function within the conventional system of denotation.

The important difference could lie in attitude more than in mastery. The bilingual appears to be more willing to utilize grammar as a tool rather than considering it as part of the background of reality. He is freer not only of word magic but also of what might be called the implicit magic of grammar. This is the semantic aspect of grammar which Whorf explored. Once free of this level of grammar, the individual is better able to grasp grammar as an abstraction.

Transposition.

In the original test by Bruner and Kenney (1966) the child was presented with nine cylinders which varied in terms of three degrees of height and three degrees of width, such that they formed a 3x3 matrix. After being encouraged to handle the cylinders in the matrix the child was asked to reproduce the matrix from memory, exactly as it was. Following this the units were scrambled again, but this time the unit which was in the lower left-hand corner, the shortest and thinnest cylinder, was placed in the opposite corner. The child was asked to make something like the pattern that was there before, but leaving the cylinder where it has been placed. If the child is to accomplish this he must transpose the matrix. Following the task the child was asked to describe the ways in which the units differ from each other. The procedure followed in the present experiment was the same as the above, with the addition of some intermediate steps to make the task demand more clear to the child.

-----Bilinguals were highly superior in the ability to name the dimensions underlying an abstract pattern (bilingual mean=4.09; monolingual mean= 3.44; MS=8.74; $p < .01$, df=1.75).

-----Bilinguals were not significantly superior in their ability to transpose a visual matrix, although the direction of the means favored them.

The first finding is evidence that the higher structural understanding and ability to reorganize found for bilinguals on strictly verbal material does generalize to nonverbal patterns.

The two findings taken together indicate that bilingualism contributes to the advancement of concrete operational thinking, but that it is not in itself sufficient to induce the onset of this stage of thinking in relation to nonverbal material.

-----For the Transposition task itself there is a significant interaction between the Bilingualism factor and the Age factor. At the younger age level the bilingual is superior to the monolingual child on the transposition score (MS=21.76, F=13.75, p<.001, df=1,75). There is no interaction effect for the Naming of Dimensions score.

There may be some connection between the above significant finding and the finding on the Paradigmatic Associations Test that the younger group of bilinguals manifested special difficulty in giving meaningful associations. The two findings taken together may mean that at the younger age level the bilinguals tend to reach the level of operational thinking precociously, at the expense of the associative type of thinking. This may be related to the effort to establish denotations, which is more difficult for the bilingual because of his limited experience. The concern with establishing denotations could be related to skill in isolating the basic dimensions in grammar as well as in external objects or patterns.

It seems that at a slightly older age level the bilingual begins to relax the intensity of his striving for mastery of reference words. This is at least partly because by then his vocabulary has made advances. He then begins to relate to the world more associatively. He can then facilitate the increase in his vocabulary by immersing himself more in experience, instead of needing to structure experience beforehand.

Essentially, the present hypothesis is that the bilingual changes his cognitive strategy during his attempt to understand the world and its structure, as he eventually begins to overcome his limited vocabulary and as he emerges from the need to develop internal structures that will counteract the threat of interlingual interference. Such a hypothesis, drawn from unanticipated results in the present experiment, requires further investigation.

Ravens' Matrices Test.

-----The total scores for bilinguals and monolinguals on this test were not significantly different. This result is similar to that found for transposition of the 3x3 matrix on the Transposition Test, which test closely resembles the Ravens in its underlying task demand.

-----The only significant differences in types of error occurred for errors due to failure to scan the field of possible responses. That is, the bilinguals were better able to resist simply choosing whichever response item happened to be adjacent to the missing item. They evidently approached the task with a more definite problem-solving orientation, similar to the analytic orientation found for them in the results of other tests already discussed.

The lack of differences for total score on this test, together with the finding that bilinguals approach this test with greater problem-solving orientation, tends to support the conclusion from the Transposition Test that bilinguals are more oriented towards the seeking out of underlying dimensions, and that this gives them some advantage in manipulating these dimensions, although not enough to make a crucial difference in terms of ability to handle concrete operations.

Degree of Bilingualism.

-----Above a certain high level of bilingualism, further refinement in the degree of bilingual balance was not found to be important for increasing structural understanding.

Discussion.

The findings of this experiment have implications for the course of cognitive development in the bilingual child as well as implications for language development in general.

Cognitive Development in the Bilingual Child.

It is likely that the vocabulary deficit found for the bilingual child and the difficulty in forming associations are temporary disadvantages of bilingualism. The more lasting characteristic is likely to be the strategy of flexibility which appeared in the results of several of the tests.

The bilingual's tendency to analyze verbal dimensions is probably an advantage for a short period during which the child makes the transition from the intuitive stage to the concrete operational stage, but soon the monolingual children rise to the same level.

General Language Development.

One thing this research indicates is that the development of language structure in the child is not a matter of smooth transition from association to structure, such as is theorized by Mandler for structural learning in lower animals (1962). The bilingual excels in understanding of language structure in spite of difficulty in associations. He has less opportunity for overlearning verbal sequences than other children.

The theory of language learning offered by Braine (1971) is also insufficient to account for the present pattern of findings. Braine's theory is that the child learns the position and role of the word in sentences as a result of cumulative experience with the verbal contexts in which the word appears. This involves what might be called passive categorization.

As a result of experience, the distributional structure of the word becomes registered. In other words, the child registers which other words can be substituted for the word in a given sentence position, and contrasts this to the types of words which can follow it. Such a mechanism probably does figure importantly in language learning, but in the present case it is insufficient to account for the results. The bilinguals do not have more experience with distributional structure for given words, yet they excel at language structure. The process must involve a strategy of active hypothesis testing on the part of bilinguals.

It is not claimed that bilinguals are unique in this strategy. On the contrary, it is claimed that their circumstances force them to exercise more actively a process of hypothesis formation and testing which occurs in language development for all children.

Braine argues that hypothesis testing could not be involved in language learning because there is evidence that children do not make use of negative instances (Braine, 1971). This argument is misleading because there is evidence that people in general do not make much use of negative instances even when they are directed to engage in hypothesis testing (Bruner, Goodnow, and Austin, 1957).

The findings of this study support the position outlined at length in the earlier portion of the thesis that language development as a process is part of the development of the individual as a human organism, in which internal structure becomes formed as a result of the need to adapt to the external environment and to maintain internal consistency.

The present findings can be seen as contributing a refinement to organismic theory, which posits that the concrete and the structural develop simultaneously. To Piaget, for example, the internal cognitive structure of the child develops as he tries to adjust to external concrete reality (Inhelder and Piaget, 1964). To Werner and Kaplan (1963) , semantics and syntactics or referential meaning and linguistic structure develop simultaneously. As a general statement of the developmental process this seems correct. On the verbal level it is illustrated by the results of Werner and Kaplan's Word-Context Test, which showed that the child cannot use the word either as a fully-developed semantic or syntactic unit until almost the time of adolescence. In the present experiment, however, it was seen that syntactic or structural language development was advanced over semantic development in bilinguals. This illustrates that in circumstances where it is necessary for the internal consistency of the organism, attention to structure can take precedence over more concrete aspects of adaptation, at least temporarily.

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Conclusion.

It will be recalled that the initial hypotheses were: (1) Bilingualism leads to increased ability to analyze syntax. (2) Bilingualism leads to acceleration in general conceptual development, and specifically in the arrival of the stage of concrete operational thinking. (3) Bilingualism leads to increase in cognitive flexibility.

After reviewing the scoring pattern for bilinguals over all the various tests in the current experiment, the third hypothesis seems to be clearly supported. The other two hypotheses appear to require restatement, because the situation is more complex than originally conceived.

The patterns which have been revieved can be summarized into the two following characteristics of the thinking of the bilingual:

Imputation of structure
Readiness for re-organization.

The bilinguals seek out the underlying dimensions in the patterns they confront. The patterns they seek out are primarily linguistic, but the same process also operates when visual patterns are confronted, as in the ability to seek out and name the dimensions involved in the Transposition task. Having been confronted in early life with a verbal environment of unusual complexity, in which the underlying order is difficult to discover because there are two orders, not one, the bilinguals seem to have developed compensatory mechanisms for seeking out that order. These mechanisms have become a cognitive trait, and so they apply more broadly than to the original audio-verbal situation. The breadth of subject matter or situations for which this trait functions needs further investigation.

The trait of readiness for reorganization is very apparent in the bilingual's behavior on both the Verbal Transformations Test and the Symbol Substitution Test. On the Verbal Transformations Test the continual repetition seems to serve as a feedback signal to the bilingual that his imputation of meaning to the stimulus has failed, since the signal cannot be placed into a meaningful verbal sequence, in other words, a sentence. The failure is the signal to reorganize one's own orientation and to make another effort after meaning.

The fact that the bilingual tends to give many different responses indicates that he is doing more than alternating his perceptions between two established systems, which is what one might expect if the original process of learning to be bilingual had merely involved switching off one of his established languages if it didn't work in the circumstances and automatically switching on the other. Rather, the bilingual seems to be able to change interpretations freely and experimentally, at least on the perceptual level. This can be considered a reflection of the

amount of active effort and the number of different approaches which had to be tried initially in the process of trying to understand language in a bilingual situation.

Another aspect of reorganization which appears on the Verbal Transformations Test is the ability of the bilinguals to desemanticize. The repeated imputation of new meanings which are not related to each other in any way implies a desemanticizing process underlying each change. If the bilingual were committed to the semantic meaning he imputes he would not be able to keep changing the meanings. The process of reorganizing the verbal stimuli on the Verbal Transformations Test implies desemantization.

The same process of desemantization followed by reorganization is quite evident in the bilingual's performance on the Symbol Substitution Test, as was mentioned in the earlier discussion of this test. Why should the bilingual have developed in this direction? Of what usefulness to him is desemantization? A likely answer appears in Hockett's (1963) listing of the basic psychological design features necessary as precursors to the development of language. One of these features is rapid fading. If the hearer were unable to let the meaning of what he is hearing fade quickly from immediate memory, then he would have no immediate perceptual space remaining to receive the meaning of the next sentence. This is true for all listeners and all speakers; but the need for rapid fading of meaning, or removal from short-range storage, is more acute for the bilingual because, faced with the complexity of his language situation, his initial imputation of meaning to the discourse he hears is more than ordinarily likely to be incorrect. He must be ready to erase the initial hypothesis and organize a new one.

The bilingual's ability to reorganize rather freely on the perceptual level was noted on the Verbal Transformation Test. The same freedom to reorganize also appears on the Symbol Substitution Test, but in the latter case the reorganization is in response to a directed effort at problem-solving, rather than merely on the level of perception. The bilingual is able to put aside the ordinary semantic connotations of words and the conventional rules of syntax in order to carry out the rules newly created by the experimental task.

This ability to reorganize may or may not be limited to verbal stimuli. The bilinguals seem to have had some advantage on the nonverbal transposition task and also the Ravens Matrices, but the advantage in these areas was not decisive.

Bibliography

(This bibliography applies to the thesis abstract, not to the thesis as a whole, for which the bibliography is more extensive.)

Arsenian, S. Bilingualism and Mental Development. New York, 1937.

Berko, J. The child's learning of English morphology. Word, 1958, 14, 150-177.

Bloom, L. Language development: Form and function in emerging grammars. Cambridge, Mass.: M.I.T. Press, 1970.

Braine, M. Two types of models of the internalization of grammars. In D. Slobin (Ed.), The ontogenesis of grammar: A theoretical symposium. New York: Academic Press, 1971.

Bruner, J. S., Goodnow, J.J., & Austin, G. A. A study of thinking. New York: Wiley, 1957.

Bruner, J.S. & Kenney, H. On multiple ordering. Ch. 7 in J. Bruner, R. Olver, & P. Greenfield (Eds.), Studies in cognitive growth. New York: Wiley, 1966.

Burling, R. Language development of a Garo and English speaking child. Word. 1959, 15, 45.

Cassirer, E. Philosophy of symbolic forms. Vol. 1: Language. New Haven: Yale University Press, 1953.

Darcy, N. T. A review of the literature on the effects of bilingualism upon the measurement of intelligence. Journal of Genetic Psychology, 1953, 82, 21-57.

Deese, J. The structure of associations in language and thought. Baltimore: Johns Hopkins Press, 1965.

Ervin, S. Changes with age in the verbal determinants of word-association. American Journal of Psychology, 1961, 74, 361-372.

Furth, H. G. A review and perspective on the thinking of deaf people. In J. Hellmuth (Ed.), Cognitive studies, Vol. 1. New York: Brunner-Mazel, 1970.

Hockett, C. F. The problem of universals in language. In J. H. Greenberg, Universals of language. Cambridge, Mass.: M.I.T. Press, 1963.

Inhelder, B. & Piaget, J. The early growth of logic in the child. New York: Harper & Row, 1964.

Inhelder, B. & Sinclair, H. Learning cognitive structures. In P. H. Mussen, J. Langer, & M. Covington (Eds.), New directions in developmental psychology. New York: Holt, Rinehart, & Winston, in press.

Klima, E. S. & Bellugi, U. Syntactic regularities in the speech of children. In J. L. Lyons & R. J. Wales (Eds.), Psycholinguistic papers. Edinburgh: Edinburgh University Aldine Press, 1966.

Lenneberg, E. H. Language in the context of growth and maturation. Ch. 4, in Biological foundations of language. New York: Wiley, 1967.

Leopold, W. F. Speech development of a bilingual child. 4 Vols. Evanston, Ill.: Northwestern University Press, 1939-1949.

Mandler, G. From association to structure. Psychological Review, 1962, 69, 415-426.

McNeill, D. Developmental psycholinguistics. In F. Smith & G. Miller (Eds.), The genesis of language. Cambridge, Mass.: M.I.T. Press, 1966.

Peal, E. & Lambert, W. The relation of bilingualism to intelligence. Psychological Monographs, 1962, 76 (27, Whole No. 546).

Penfield, W. & Roberts, L. Speech and brain mechanisms. Princeton, N. J.: Princeton University Press, 1959.

Piaget, J. Personal in M.C. Almy, Young children's thinking. New York: Teacher's College Press, 1966.

Raven, R. Language acquisition in a second language environment. International Review of Applied Linguistics. 1968, 6, 175-185.

Ronjat, J. Le développement du language observé chez un enfant bilingue. Paris: Librarie Ancienne H. Champion, 1913.

Sapir, E. Language: An introduction to the study of speech. New York: Harcourt, Brace, 1949.

Smedslund, J. The acquisition of conservation of substance and weight in children. V. Practice in conflict situations without external reinforcement. Scandinavian Journal of Psychology, 1961a, 2, 156-160.

Smedslund, J. The acquisitiin of conservation of substance and weight in children. VI. Practice on continuous vs. discontinuous material in problem situations without external reinforcement. Scandinavian Journal of Psychology, 1961b, 2, 203-210.

Warren, R. M. & Warren, R. P. A comparison of speech perception in childhood, maturity, and o d age by means of the verbal transformation effect. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 142-146.

Weinreich, U. Languages in contact. New York: Linguistic Circle of New York, 1953.

Werner, H. & Kaplan, B. Symbol formation: An organismic-developmental approach to language and the expression of thought. New York: Wiley, 1963.

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